

# ASP VOCALS

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**Deployment- One Month in  
the field between October  
15 and November 15, 2008.**

**Flight hours- Between 60  
and 70 research hours  
depending on budget.**



**DOE G-1 Aircraft**

# VOCALS

**Location- Arica, Chile,  
about 5 miles south of the  
Peruvian border.**



## Objective

**Overall objective is to examine how the chemical and microphysical properties of aerosols, and their ability to act as CCN differs between remote marine air-masses and marine air-masses that have been influenced by anthropogenic aerosols, and how these differences in aerosol loading and properties influence the properties of the clouds that form in these different environments.**

# Participants

**Major Platforms- NSF C-130; CIRPAS Twin Otter; NOAA RV Ron Brown; Facility for Airborne Atmospheric Measurements (FAAM) BAe 146; Ground site near Iquique.**

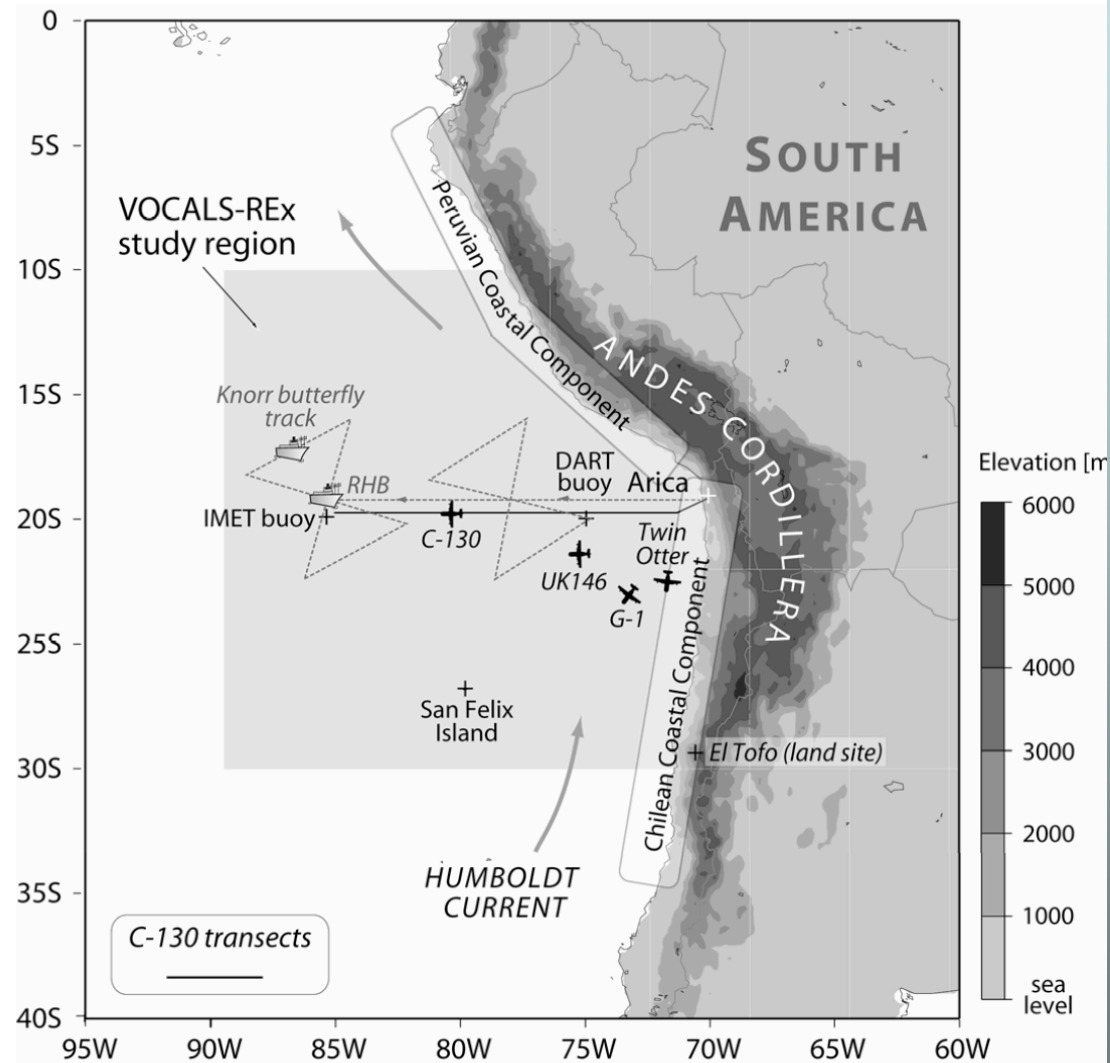
**C-130 & BAe 146 equipped with a comprehensive array of instruments to measure aerosol and cloud microphysics, trace gas concentrations, aerosol composition, and a selection of remote sensing instruments (Lidars, cloud etc.)**

**For More Information go to the website-**

**<http://www.eol.ucar.edu/projects/vocals/>**



# Conceptual Design



## G-1 Payload- Aerosol and Cloud Microphysics

Parameter	Instrument	Source
Aerosol Size distribution 0.1 – 3 $\mu\text{m}$	PCASP	PNNL
Aerosol size distribution 30 – 120 nm	FIMS	BNL
Aerosol concentration $d > 10$ nm	TSI 3010	PNNL
Aerosol concentration $d > 3$ nm	TSI 3025	PNNL
Cloud droplet and drizzle size distribution	DMT CAPS	BNL
Cloud liquid water content	Gerber Probe/CAPS Probe	PNNL/BNL

## VOCALS Payload- Aerosol Properties

Parameter	Instrument	Source
Aerosol composition- soluble inorganic and organic species	PILS	BNL
Aerosol composition	Aerodyne ToF-AMS (high resolution)	BNL/PNNL/ Aerodyne
CCN	3 DMT CCN 1 dual, 2 single	BNL/PNNL
Aerosol extinction and backscatter	TSI 3 $\lambda$ Integrating Nephelometer	PNNL
Aerosol absorption	Photothermal	BNL

## VOCALS Payload- Trace gases

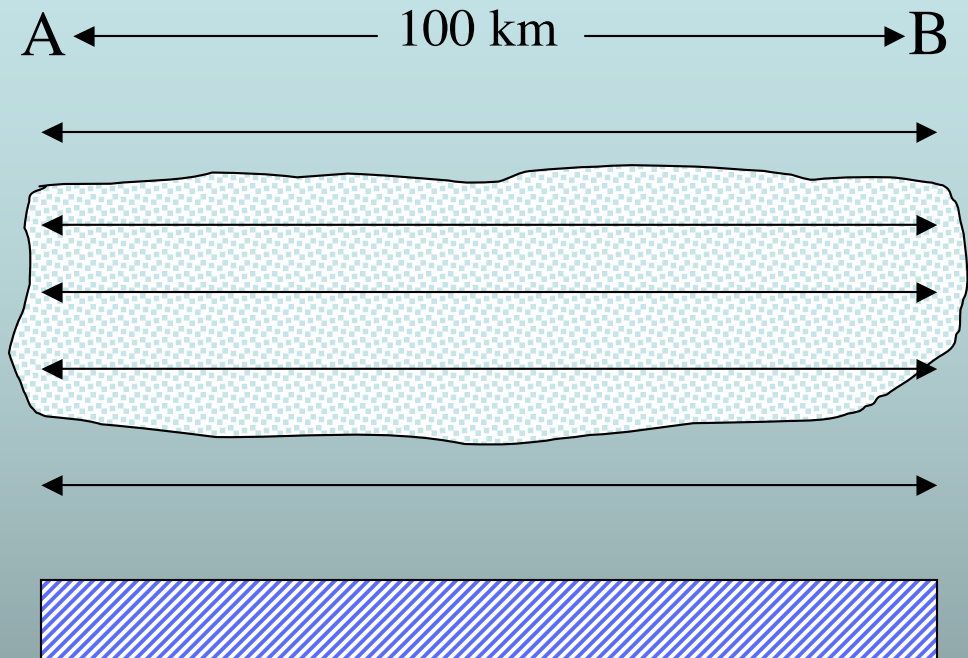
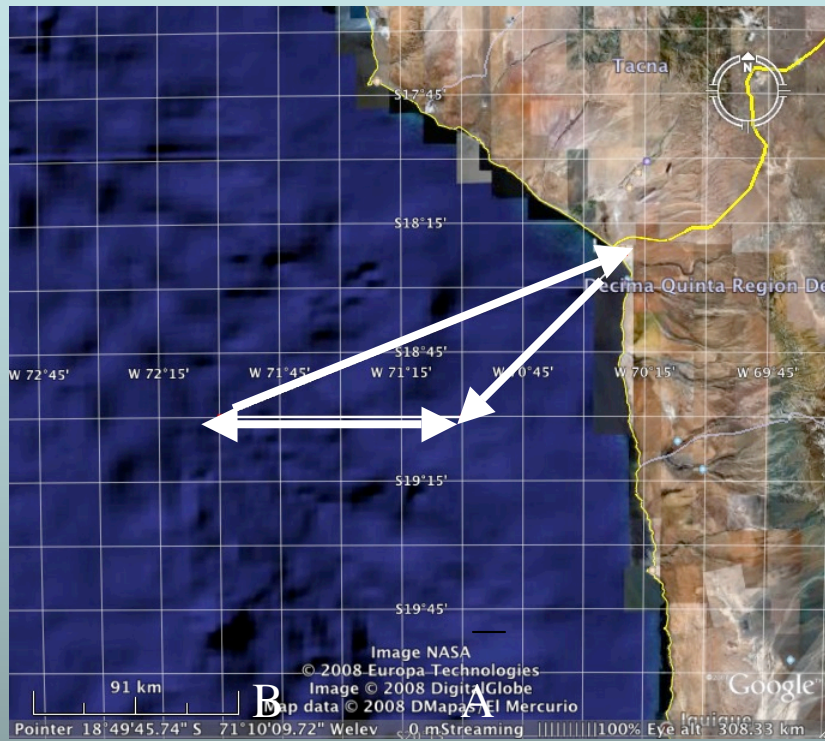
Parameter	Instrument	Source
O <sub>3</sub>	Thermo Electron 49-100	BNL
CO	UV Fluorescence	BNL
SO <sub>2</sub>	Thermo Electron 43S modified	BNL
DMS/Organics	PTRMS	PNNL

# Flight Plans

## Basic flight strategy

1. Below cloud leg(s) to measure aerosol composition, size distribution, CCN spectra, vertical velocities and their variability.
2. Multiple altitude in-cloud legs to measure cloud microphysical properties and their variability both with respect to location and altitude.
3. Above cloud leg to characterize chemical and microphysical properties of above cloud air.

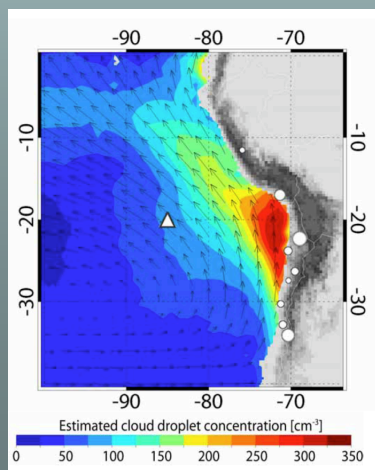
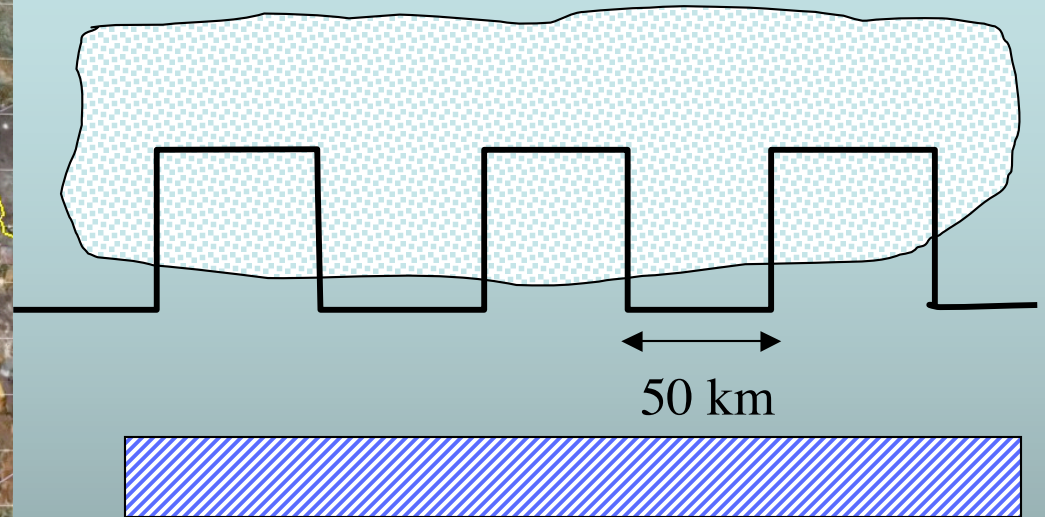
# Basic Flight Plan



Strategy of basic flight plan is to get statistically meaningful data on properties of clouds and the conditions under which they were formed by by flying ~100 km legs below-, in- and above-cloud.

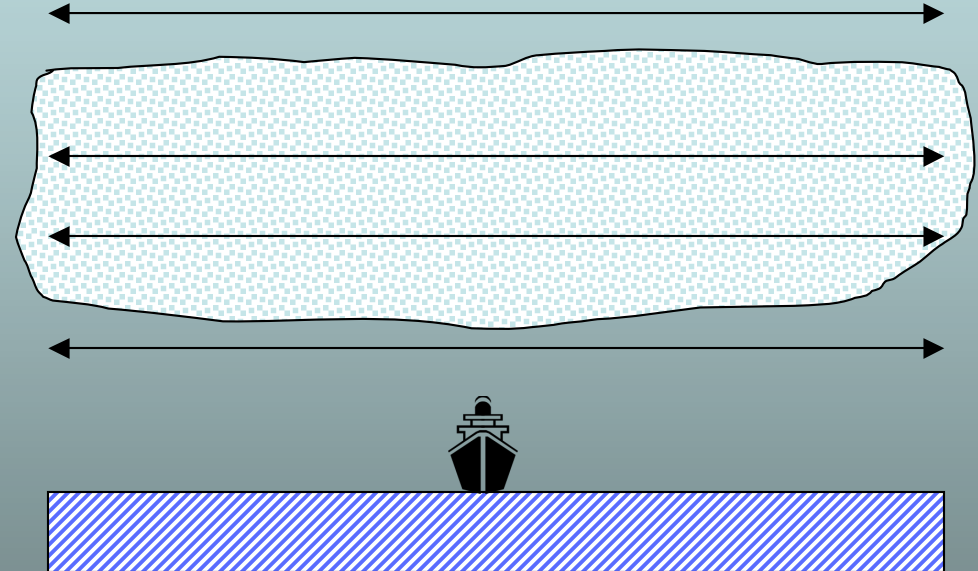
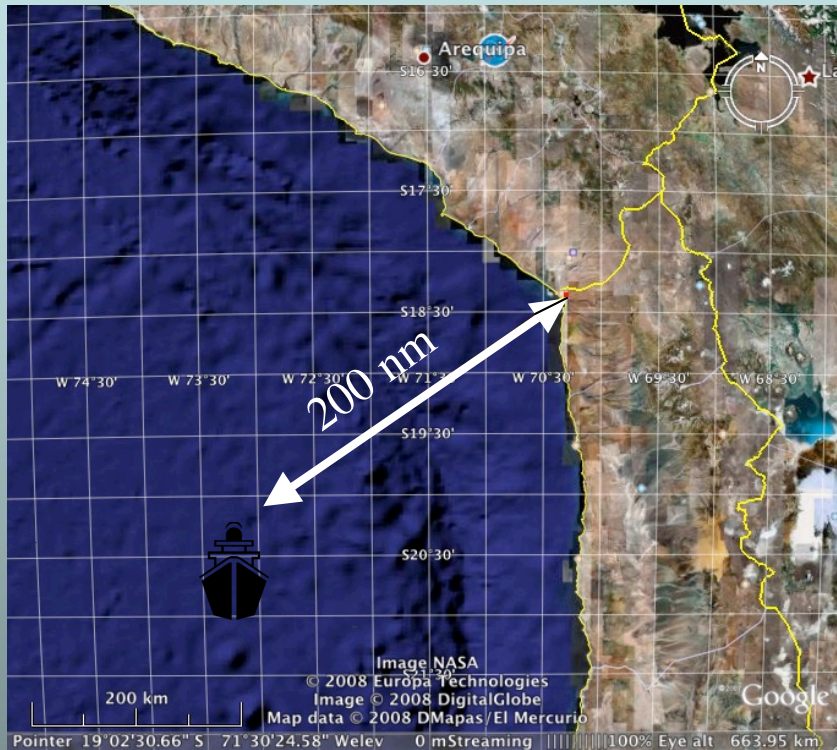


# Gradient Flight Plan



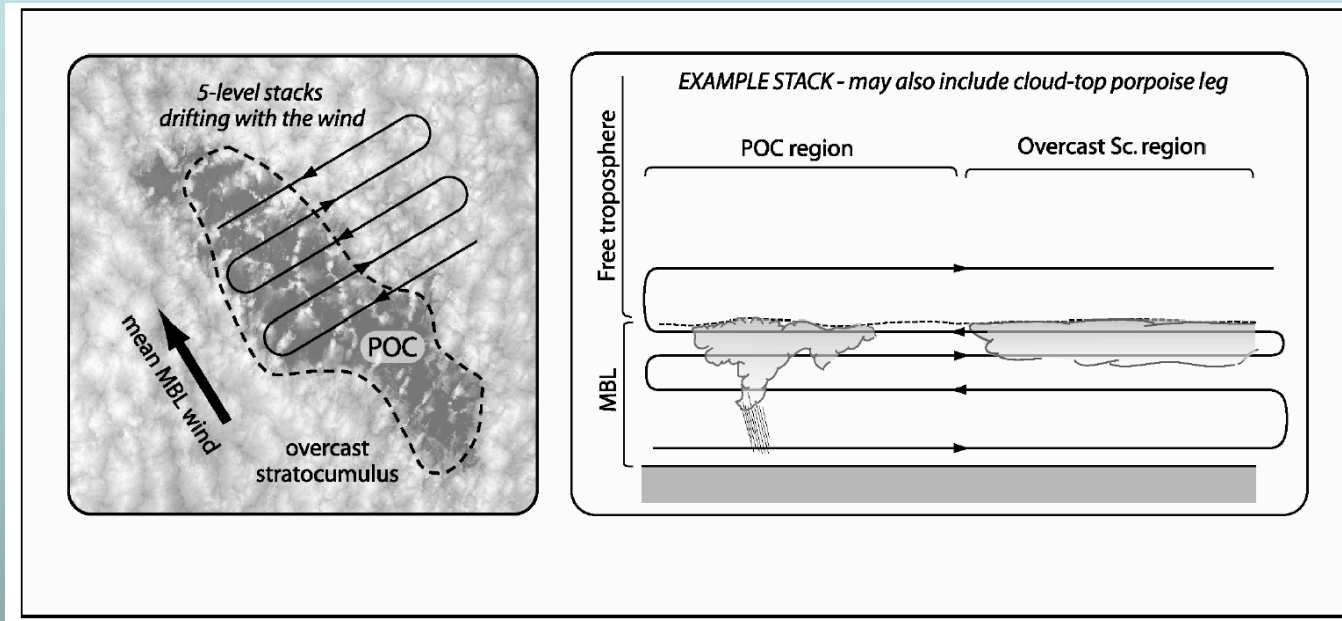
Objective is to characterize gradient <sup>□</sup> in CCN and cloud microphysical properties that has been inferred from satellite measurements.

## Overpass of the Ron Brown



For G-1 Flight to be useful, Ron Brown must be within 200 nm of Arica. This allows 1 hr transit, 2 hrs sampling above the Ron Brown, and 1 hr transit back to Arica.

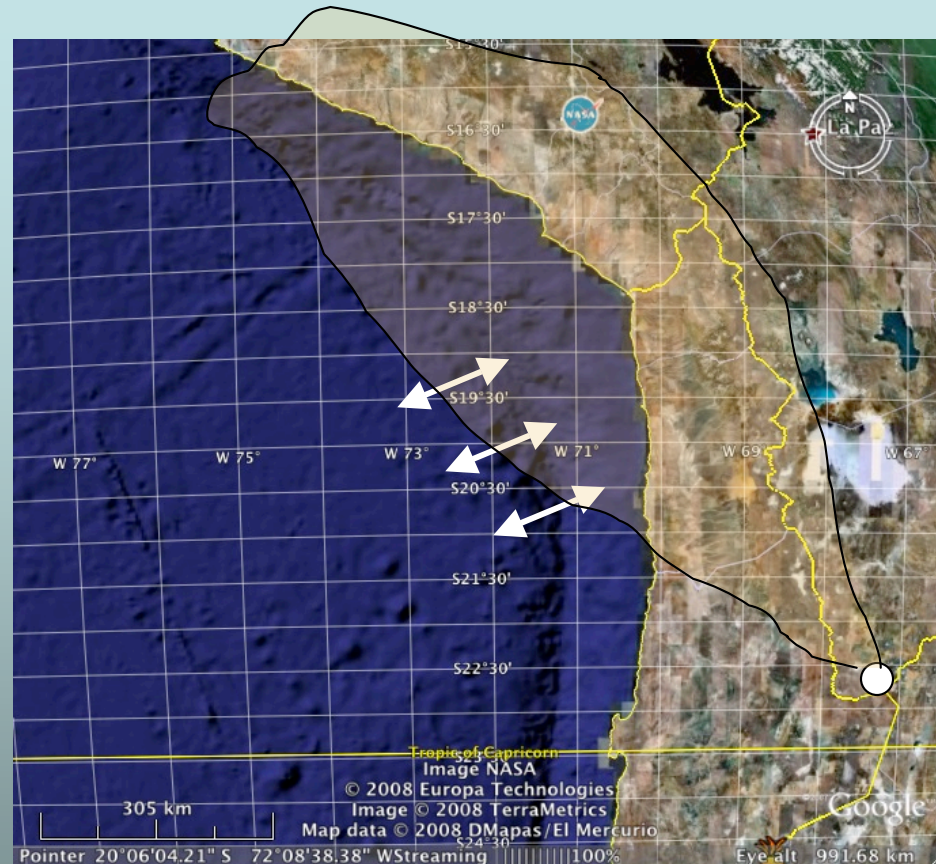
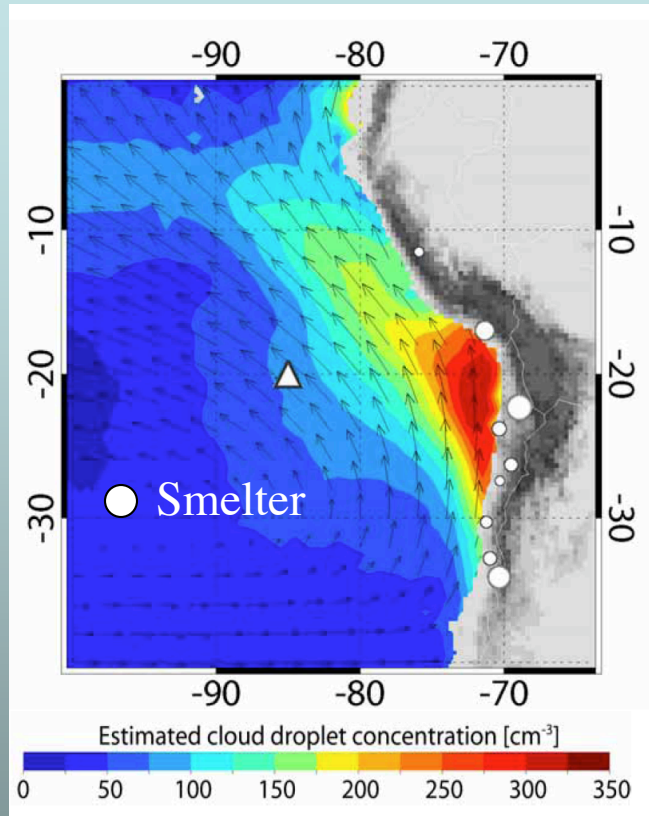
# Pockets of Open Cells (POC) Flight Plan



POC flights will occur primarily in collaboration with the C-130 who will locate cells and conduct initial sampling. POC's must be within ~200 nm of Arica for useful sampling to be conducted.



# Smelter Plumes Flight Plan

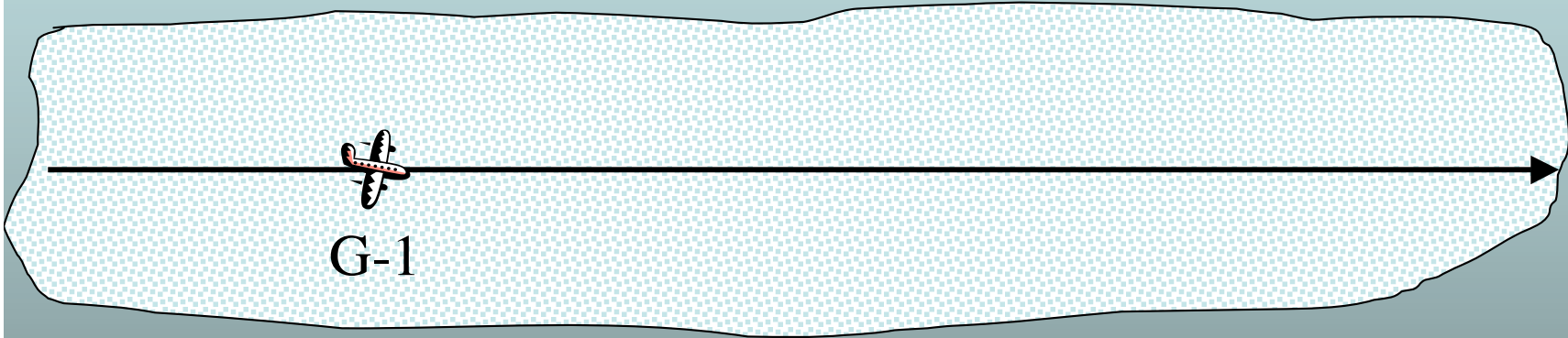


Under appropriate flow conditions, characterize in- and out-of plume cloud properties. Vertical profiles obtain information on entrainment.

## Joint Flights With The C-130



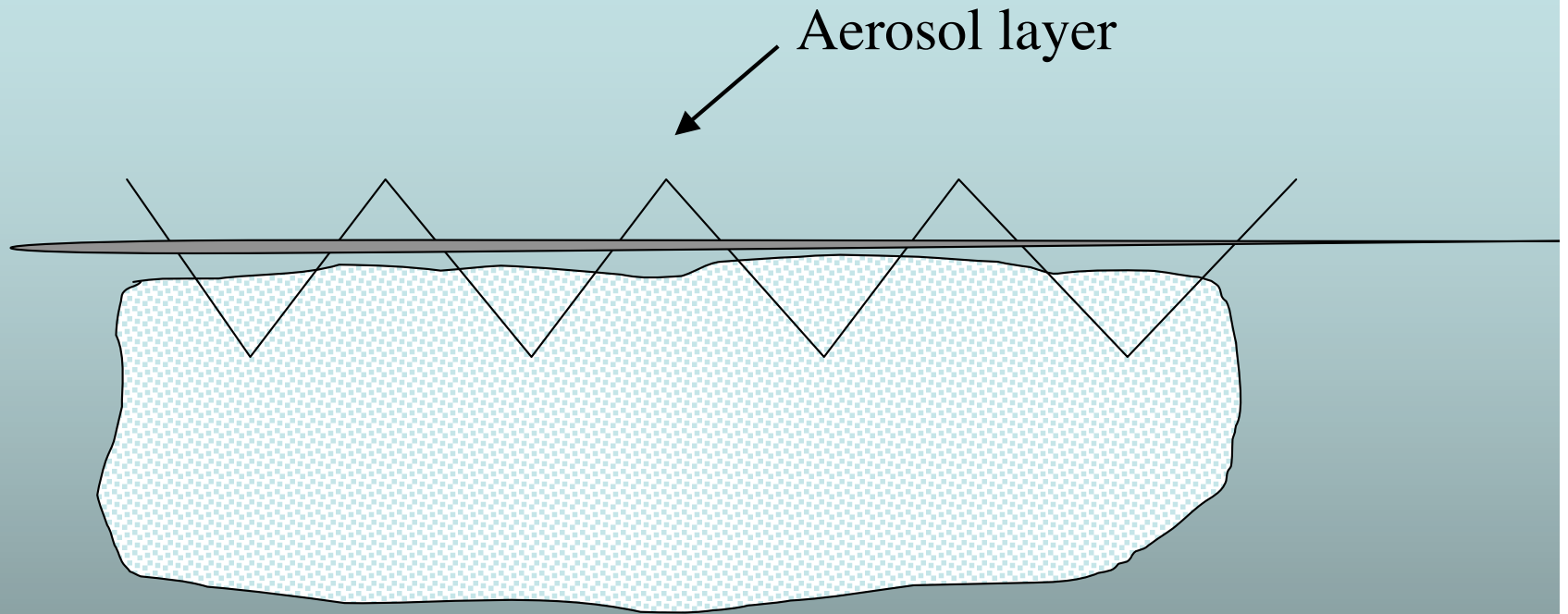
C-130



G-1

Objective of these flights is to link remote sensing measurements of cloud properties by the C-130 to in-situ cloud properties measured by the G-1. Of interest are C-130 cloud radar, and radiation fields measurements. Such flights are planned to be conducted towards the end of the C-130 flights within about 200 nm of the coast.

## Sampling the Interface between cloud-top and the free troposphere



Determine whether aerosol layer observed just above cloud-top during MASE is also seen in VOCALS.



## **Planning-**

**VOCALS Planning Workshop June 11-12, 2007**

**Visit to Chile with NCAR and NSF PI, made in September 07.**

**Visit with NSF PI (Rob Wood) at U. Washington to develop joint flight plans.**

**VOCALS Planning Workshop March 17-19, 2008**

**Send additional objectives along with suggestions for flight plans to- [phdaum@bnl.gov](mailto:phdaum@bnl.gov)**

# Scientific Questions

## 1. Aerosol/CCN properties

What is the importance of various sources of aerosols and aerosol precursors to aerosols that function as CCN. DMS?, Sea-salt, anthropogenic SO<sub>2</sub>? How does the importance these various sources change with distance from the coast?

What are the relationship between aerosol size, composition and CCN activity? Are they different from those found in other programs

How does this relationship vary between remote marine aerosols and aerosols that have been influenced by anthropogenic sources?

# Scientific Questions

## 1. Aerosol/CCN properties (cont'd)

What is the flux of DMS from the ocean surface and how does it vary as a function of ambient conditions? Are variations in DMS fluxes/concentrations correlated with the presence of DMS oxidation products in aerosols.

## **2. Aerosol properties and cloud microphysics**

**What are the effects of aerosol loading, size distribution, and composition on the microphysical properties of the clouds. Is the relationship between aerosol loading and droplet number concentration linear?**

**Is the spectral dispersion of the droplet size distribution a function of aerosol loading and/or aerosol composition? Is the spectral dispersion of remote marine clouds smaller than those that have been influenced by anthropogenic aerosols?**

**Is a layer of high aerosol concentrations observed just above cloud top as in MASE?**

### **3. Aerosols, cloud microphysics and drizzle**

**Are gradients in cloud droplet microphysics consistent with gradients in drizzle concentration? Are these gradients in microphysics associated with gradients in aerosol loading?**

**Do newly developed parameterizations for the drizzle threshold and rate functions hold over the range of cloud properties observed over the NE Pacific?**